



# Multi-Mode Magnetic Detection System (3MDS)

ONR Program Code 321

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## At a Glance

### What is it?

■ The Multi-Mode Magnetic Detection System (3MDS) is the latest generation of airborne Magnetic Anomaly Detection (MAD) technology for use by rotary-wing and fixed-wing Anti-Submarine Warfare (ASW) platforms. 3MDS has been given the military system nomenclature of AN/ASQ-233.

### How does it work?

■ The 3MDS system is based on the helium-4 (He4) atomic magnetometer technology. Helium sensor technology has been incorporated into experimental and developmental airborne and sea bottom sensor systems going back to the 1970s.

### What will it accomplish?

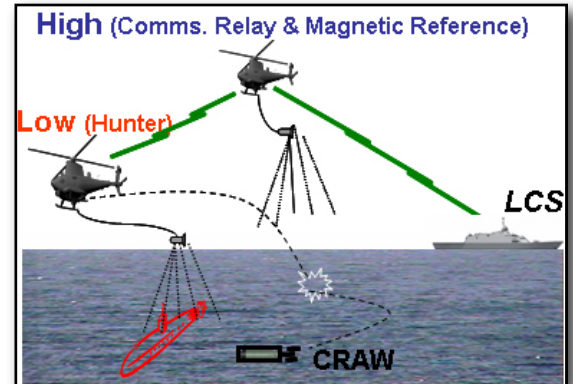
■ 3MDS provides the warfighter with a MAD sensor that performs 20dB to 40dB better than the MAD sensor systems currently fielded in the P-3C and SH-60B fleets. 3MDS will also provide detection capability in the Extremely Low Frequency (ELF) band that currently does not exist.

### Point of Contact

Dana Hesse  
(703) 696-8557  
dana.hesse@navy.mil

The concept of using magnetic sensors on aircraft to detect submerged submarines has been around for approximately 60 years. Previous generations of Magnetic Anomaly Detection (MAD) sensors were limited in their detection range. Beginning in the late 1990s,

investments from the Office of Naval Research (ONR) and other agencies, along with system manufacturer Polatomic, Inc., moved the technology towards laser cell pumping and away from inefficient high-intensity optical lamps. This new method for optical pumping, coupled with improvements in GPS and in processing capability, has enabled this major step in non-acoustic detection of submarine threats.



The Multi-Mode Magnetic Detection System (3MDS) consists of two glass cells filled with He4 molecules that are stimulated by laser light. The precession of the pumped molecules is sensed by fixed coils around cells consisting of several thousand turns of fine wire. Very small changes in the ambient magnetic field cause changes in the precession characteristics and these are sensed by the pickup coils. The pickup cell signals are digitized in the sensor unit. Control of the laser source as well as most other aspects of system operation is also contained in the sensor unit (including GPS, accelerometers, vector magnetometer, etc.). A computer/power unit internal to the aircraft provides serial communications and DC power to the sensor unit, and either a laptop or a small military display provides the operator interface. 3MDS will work in a single aircraft scenario, but two systems flying at the same time give optimum performance.

Benefits to the warfighter include:

- Longer detection range in areas of low (deep) geological noise sources in the sea bottom
- Exploitation of ELF electromagnetic signatures to improve detection opportunities in areas of high (shallow) geological noise sources
- Approximately 8x reduction in required equipment volume on the air platform compared to AN/ASQ-208
- Target re-localization capability is sufficient to allow immediate engagement with Compact Rapid Attack Weapon (CRAW) very lightweight torpedo now under development

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